SWIFT-UVOT-CALDB-10-R03
Date Original Submitted: 28th October 2005
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Date Revised: 13st February 2007
Revision #03
Revised by: Tracey Poole
Pages Changed: All
Comments:

SWIFT UVOT CALDB RELEASE NOTE

SWIFT-UVOT-CALDB-10-R03: Zodiacal Light

0. Summary:

This product provides the in-orbit zodiacal light values for the 7 lenticular filters of the UVOT.

1. Component Files:

FILE NAME	VALID DATE	RELEASE DATE	VERSION

2. Scope of Document:

This document contains a description of the zodiacal light calibration analysis performed to produce the zodiacal light calibration products for the UVOT calibration database.

3. Changes:

This is the second release of the in-orbit zodiacal light values, replacing first estimates.

4. Reason For Update:

An update was undertaken to improve the zodiacal light calibration using the updated in-orbit effective area curves.

5. Expected Updates:

Further updates will follow any updates in effective area. Measured background comparisons may also lead to further updates.

6. Caveat Emptor:

Due to the lack of faint spectroscopic standard stars, especially in the ultraviolet, the effective area curves have been calibrated with very few stars.

7. Data Used:

No in-flight swift data were used.

8. Description of Analysis:

Zodiacal light (B_{zl}) is due to sunlight scattered by interplanetary dust particles, and is seen at ultraviolet, optical and near infrared wavelengths. Its brightness is a function of wavelength, heliocentric distance, and position of the observer relative to the symmetry plane of interplanetary dust. In general zodiacal light (ZL) is smoothly distributed with small scale structures appearing only at the level of ~few %; its brightness does not vary with the solar cycle to within 1% (Dumont & Levasseur-Regourd, A&A, **64,** 9, 1978, and Leinert & Pitts, A&A, **210**, 399, 1989).

8.1. Background Intensity

The ZL background Intensity (I_{zl}) was produced using the smoothed brightness values from Levasseur-Regourd & Dumont (A&A, 84, 277, 1980; Table 2 - in units of S10), for elliptic longitudes of 50^{o} to 130^{o}. The ZL intensity map can be seen in Figure 1.

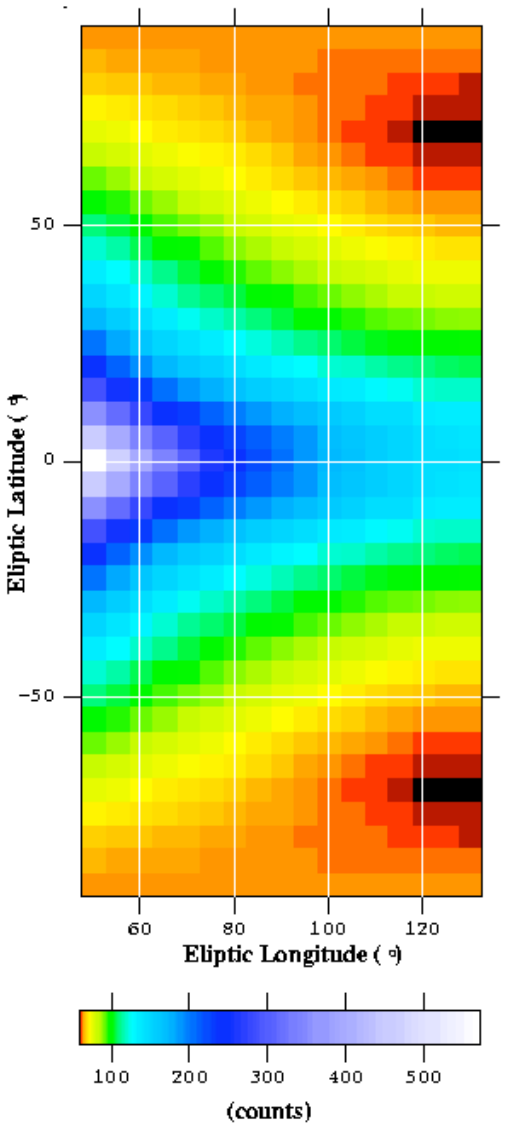

Figure 1 – ZL intensity map. This map is included in the ZL CALDB file.

8.2. Throughput of filter

To find the throughput (f_{tp}) of each UVOT filter, the spectrum of ZL needs to be considered. The spectrum used in this case was a G2 type star (as the Sun is a G2V star). The spectrum used can be seen in Figure 2.

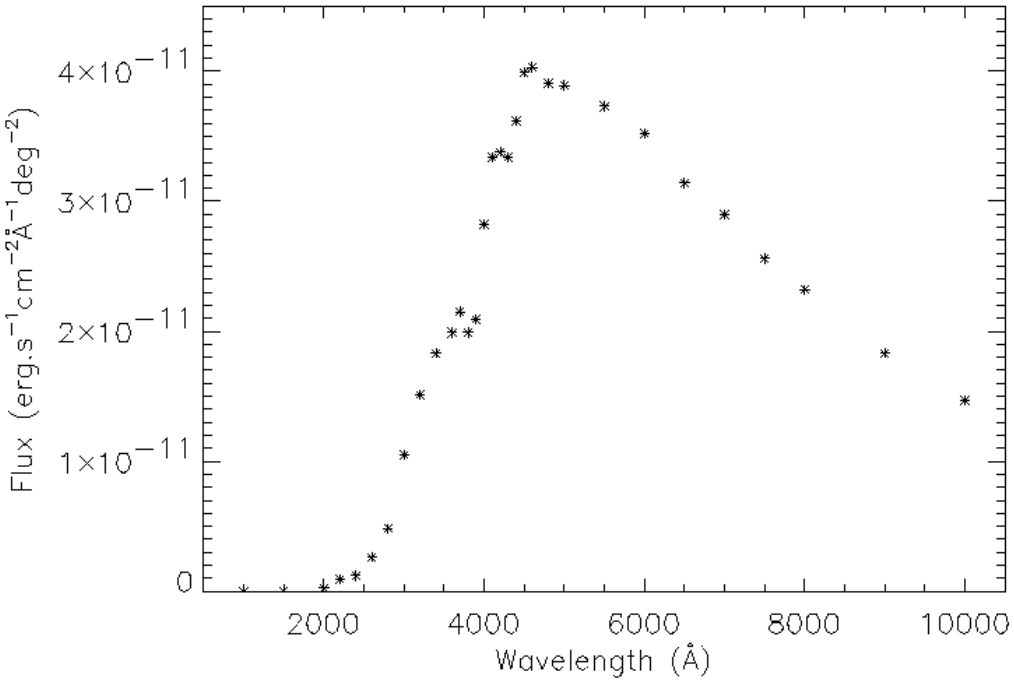

Figure 2 - Corrected spectrum of G2 type star used for ZL. This spectrum is included in the ZL CALDB file.

This ZL spectrum was then convolved with in-orbit filter effective area curves (uvot_caldb_effectiveareas_02a.doc), with a reference intensity of 100 S10. The final throughput results can be seen in Table 1.

Filter	Zodiacal Light ($ph.s^{-1}arcsec^{-2}$)
V	0.01093
B	0.01879
U	0.008742
White	0.04890
UVW1	0.001146
UVM2	0.000110
UVW2	0.000224

Table 1 -Filter throughput for Zodiacal Light spectrum of reference intensity 100 S10. This table is included in the ZL CALDB file.

8.3. Intensity of reference

Intensity of reference spectrum (I_{ref}) is 100 S10.

8.4. Results

The total background intensity of ZL can be found for a given elliptic longitude and latitude in a UVOT filter using

$$B_{zl} = \frac{I_{zl} f_{tp}}{I_{ref}},$$

where I_{zl} is the intensity of ZL background given by the intensity map in Figure 1, f_{tp} is the filter throughput for the ZL background given in Table 1, and I_{ref} is 100. Results of the minimum and maximum count rates can be seen in Table 2, where the minimum ZL is found using the UVM2, and the maximum using the White filter.

	Filter	B_{zl} (ph.s^{-1}arcsec^{-2})	Longitude (^{o})	Latitude (^{o})
Min.	UVM2	6.71×10^{-5}	105	70
Max.	White	0.145	70	0

Table 2 – Results of ZL background.